Journal of Applied Research in Science and Humanities

# Extraction of oils from different plants and their applications in our daily life

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## Abstract

**Extracting oils from plants is a critical issue to study. In this article, three oils were extracted. sesame oil, flaxseed oil and black seed oil, respectively. They were extracted using solvent extraction as a one of several techniques of extraction of oils. The structure of these oils is investigated using simple chemical tests. These oils have been used in different applications. These seed oils can be utilized for industrial, cosmetics and pharmacological purposes as well. Sesame oil is used to produce body lotion and sunscreen. Flaxseed oil is applied to produce moisturizer and anti–wrinkle treatment and burn relief ointment for soothing and healing minor burns. Black cumin (black seed oil) is used to produce a product of joints treatment.**

## Key Words:

**sesame oil, flaxseed oil, black seed oil, solvent extraction, applications**

## 1. Introduction:

**Since ancient times, humans have considered plants a primary source of food, medicine and beauty. They contain a wide variety of beneficial ingredients, including a wide variety of diverse components named oils and are effective in a wide range of fields, including alternative medicine, cosmetics, and the food. These oils are extracted from different parts of the plant, such as seeds, fruits, and leaves, using multiple methods and techniques aimed at obtaining the highest possible quality while preserving the vital properties of the active compounds. The importance of oil extraction lies in its delicate process, which represents the link between the raw plant material and the multiple uses it provides for human daily life.**

In this article, we will discuss the extraction of sesame, flaxseed and blackseed oils using solvent extraction technique and the different applications of them in our daily life .

2. The Theoretical Framework

A vegetable oil is a fatty substance extracted from an oleaginous plant (flax, sesame, sunflower, ..), we can say , from a plant that has the particularity of accumulating mainly oils in their seeds, nuts or fruits, its Nutritional value is based on its intake of essential fatty acids (essential) omega 3 and omega 6 or vitamins. oils are used in a wide variety of consumer goods such as detergents, soaps, toilet products, cosmetics, pharmaceuticals, perfumes, confectionery food products, soft drinks, distilled alcoholic beverages (hard drinks) and insecticides (Bouhadi et al., 2018, 136). The world production and consumption of essential oils and perfumes are increasing very fast. Sesame seeds are one of the most important seeds as it contain two substances sesamine and sesamin known to lower cholesterol in humans and to prevent hypertension (Anilakumar et al., 2010, 160).Sesame oil (Sesamum indicum L.) contains many bioactive compounds such as phytosterols, tocopherols and lignans including sesamin, sesamolin and sesamol which have antioxidation properties. Sesame oil is high in oleic and linoleic fatty acids which are unsaturated. In fact, sesame oil shows high oxidative stability presumably due to the indigenous antioxidants (Kaviani et al., 2015, 22). Other seeds are important are flaxseed, also called linseed (Linum usitatissimum) is a major oilseed crop belonging to Lineaceae family. Flax grows in various regions of the world such as India, Argentina, America, China, Canada, etc. Among these countries, the world's largest exporter of flaxseed is Canada accounting for 75% of global flaxseed trade and produces 40% of entire world's flaxseed (Pradhan et al, 2010, 393) (Sharma et al., 2019, 2). Flaxseed is a nutrition booster and plays an important role in increasing the quality of food (Marpalle et al., 2014, 614). A researches suggested that addition of roasted flaxseed in bread led to increase in the calorie content, low glycemic index and high antioxidant (Marpalle et al., 2015, 2). Every part of the plant can either be used directly or can be utilized in processed form. The stem of flax contains the best quality fiber having strength and durability. Flaxseed is also rich in its nutritional value. The seeds of flax are rich in oil having omega–3 fatty acids, proteins and lignans (Singh et al., 2011, 210). Flaxseed constitutes 40–45% lipids, 20–25% protein, 20–25% fiber and 1% lignans (Tirgar et al., 2017, 417).The flaxseed is mainly utilized for the industrial purposes such as manufacturing of paint, inks, cosmetic products and varnishes. Flaxseed is the main focus of the researchers due to its various health benefits by its main biological active components such as alpha–linolenic acid, lignan–secoisolariciresinol diglycoside (SDG) and dietary fibers (Toure & Xueming, 2010, 261). In the last few decades flaxseed, an underutilized oilseed has gained importance as functional foods due to

its unique nutrient profile (Kaur et al., 2018, 2). The increased health concerns of saturated fats have led to the utilization of omega–3 polyunsaturated acids (Khattab & Zeitoun, 2013, 338). Flaxseed oil has high amounts of polyunsaturated fatty acids and less saturated fatty acids. However, this property also makes it receptive to the oxidative rancidity that reduces the shelf life of flaxseed oil. Therefore, flax oil is not preferred for cooking (Malcolmson et al., 2000, 235). Flaxseed is rich in lignans among which SDG is the main lignan and has health benefits (Kaur et al., 2018, 2). It has anti carcinogenic and antioxidant effects. With the action of bacterial flora, it gets digested in the colon to produce mammalian lignans and protects the human from breast and prostate cancer (Jawad et al., 2013, 1455). Flaxseed proteins are useful for the immune system. They are rich in arginine and glutamine, so they keep the heart healthy. Flaxseed proteins also have a fungistatic effect against the plant and human pathogens (Hassan et al., 2014, 70).these potential health benefits of different flaxseed components. Other seeds are commonly used are the seeds of black cumin (Nigella sativa L.) which belongs to the family Ranunculaceae with various medical benefits, despite its commercial importance as a spice. The seeds are widely used as a spice in Middle Eastern and Indian cuisines and have a strong bitter flavor and aroma; for this reason, they are used to flavor curries, vegetables, and legumes (Datta et al., 2012, 1). N. sativa grows up to 20–30 cm tall, with finely divided, linear leaves. The flowers are square, delicate and typically colored pale blue and white, with 5–10 petals. The fruit could be a massive and inflated capsule composed of 3–7 united follicles, each containing various Seeds. Black cumin and its primary ingredient, thymoquinone, have been shown to have anti nociceptive, hypotensive, bronchodilator, ant – histaminic, anti–fertility, spasmolytic, immune stimulating, choleretic, uricosuric, hypoglycemic, hepatoprotective, neuroprotective, milk production, anti–tussive, anti–inflammatory, anti–carcinogenic, anti–hyperlipidemic, anti–cancer, antioxidant, antidiabetic, anti–hypertensive, analgesic, and anticonvulsant properties, in recent pharmacological research (Nyemb et al., 2022, 107) (Li et al., 2023) (Naghsh et al., 2023, 105565). Black cumin seed oil (BCSO) is a significant source of oils with nutritional, commercial, and medicinal importance. The traditional and folklore applications of black cumin seeds (BCS) have been documented throughout human history, suggesting that this plant can be a useful source of future medicines. For centuries, people all over the world have used BCS and oil to cure a wide range of illnesses. Thymoquinone and its isoforms are the main chemical constituent of the essential oil of Nigella and are responsible for its main medicinal benefits (Hannan et al., 2021, 2)(Nyemb et al., 2022) (Ahmad et al., 2013). According to Fidan et al (Hafize et al., 2019, 2)the major amino acids in Nigella sativa L. are glutamic acid, arginine, and leucine. Niacin content in BCS was found to be high.

Ca, K, as well as P, are the three main minerals. For the food business, BCSs might be recommended as a possible source of new products and services with high nutritional content. There is a necessity for the development of innovative extraction techniques. Various methods like phase extraction, enzyme–assisted extractions and supercritical extractions are in practice. The newer techniques should give high yield, consume less energy and time and be eco–friendly with less use of the chemicals. Traditional methods used for extraction were time and energy consuming. Due to the use of different solvents, there were high risks of different health hazards. The different techniques opted for extraction of oil, lignans, phenolic acids and protein are reported (Hassan et al., 2014, 70).

## 3.Methods of Research and the tools used

### 3.1. Materials used

Sesame seeds, flax seeds, black seeds, distilled water, ethanol $C_2H_5OH$, petroleum ether, sodium hydroxide NaOH, potassium permanganate ($KMnO_4$), iodine solution ($I_2$), glycerine, lavender oil, aloe vera gel, pure honey, coconut, salicylic acid, apple cider vinegar and vitamin E capsule, jojoba oil and bee wax.

### 3.2. Tools used

Steam distillation apparatus, separating funnel, measuring conical, sensitive balance, test tubes, beakers, spatula, pipette and containers.

### 3.3. Methodology for oils extraction

Firstly, for extraction of sesame oil 50 grams of sesame seeds are grained then added to a certain amount of dis water in 1:3 molar ratio in steam distillation apparatus. After boiling we receive condensed liquid on a measuring conical then adding a suitable amount of ethanol as solvent extraction to extract sesame oil from the received liquid. By adding ethanol, the liquid separated to two layers one of them containing oil, using separating funnel to collect oil then purify this layer to the pure sesame oil. To make sure that the produced oil is sesame oil we carry out some simple chemical tests to investigate it. The saponification test is applied by adding 5ml of NaOH solution to 2ml of sesame oil and two drops of distilled water with shaking added a foam is formed as shown in Figure 1a. Another chemical test is carried out by adding 2–4 drops of acidified solution of potassium permanganate ($KMnO_4$) to 5ml of sesame oil. The color of potassium permanganate disappeared as shown in Figure 1b. Secondly, the extraction of flaxseed oil, a certain amount of flaxseed is grinded to a fine powder then adding ethanol to it in 1:5 molar ratio in steam distillation device. After boiling the condensed liquid which contains flaxseed oil is collected in a beaker. Using petroleum ether as solvent extraction to extract the oil. by adding a suitable amount of petroleum to the condensed liquid, separated into two layers. Using separating funnel, we can obtain flaxseed oil then purify it .To make sure that this is flaxseed oil, some

confirmatory chemical tests are carried out as iodine test which resulted in the absence of iodine solution color which confirms the presence of flaxseed oil. A saponification test also carried out and resulted in the formation of a foam which gave good evidence for the presence of flaxseed oil. Finally, the extraction of black cumin or black seed oil is achieved as flaxseed oil and is tested by saponification test.

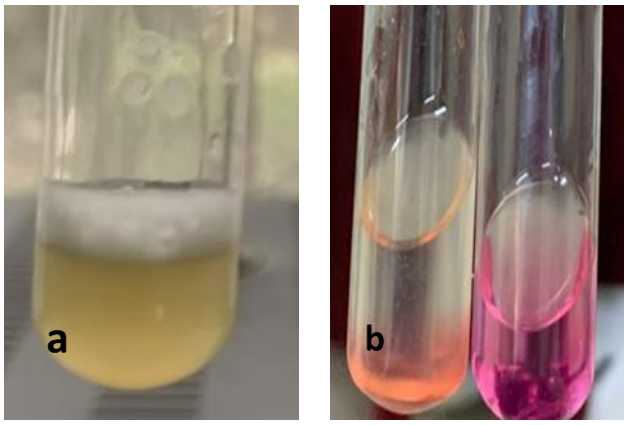


Figure 1: a. Saponification test for sesame oil, b. The disappearance of $KMnO_4$ color.

## 3.4.Methodology for applications of extracted oils

For sesame oil, sesame oil has multiple health and cosmetic benefits, and it is considered one of the natural oils suitable for various uses, as skincare, haircare and medical applications (Anilakumar et al., 2010, 160). We achieve skincare application as a body lotion, by adding sesame oil to jojoba oil to coconut oil in a certain amount. Mix them, then for a complete mixing dissolve them in a water bath. After complete mixing, a starch solution is added, then a mixture of 0.5 gm of salicylic acid and 2 ml of glycerin are added to the oils mixture as a result the lotion is formed as shown in Figure 2. This lotion must be saved in a dry and clean glass container and stored in low temperature. Another skincare application is the production of sunscreen from extracted sesame oil. In a clean container, add the sesame oil with glycerin and lavender oil, then mix well. Add the aloe vera gel and stir until smooth. Empty the vitamin E capsule into the mixture and blend thoroughly. Store the mixture in a dark glass container in a cool, shaded place.

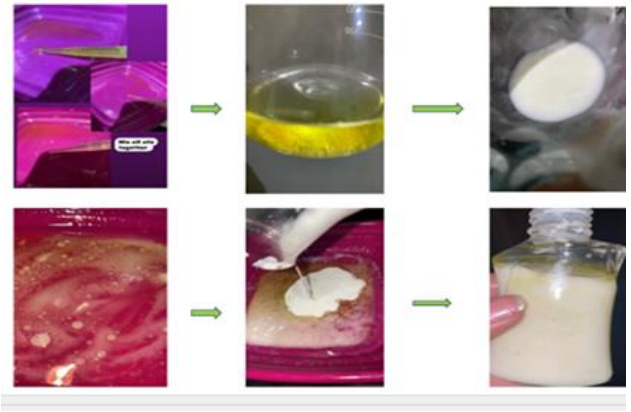

Figure 2: body lotion from sesame oil.

For flaxseed oil it can be used as moisturizer and anti–wrinkle treatment as an application as shown in Figure 3. This skin care product is prepared by mixing a certain amount of flaxseed oil to aloe vera generation and honey . This product can be used two times in a week. Another application is "burn relief ointment for soothing and healing minor burns." which can be achieved by melting one spoon of bee wax with one spoon coconut oil then gradually add three spoons of flaxseed oil to the melted mixture with continuous stirring for a complete mixing

then add aloe vera gel and lavender oil to the mixture, stirring till the product is formed as indicated in Figure 4. Pour the cream into a clean, sterilized glass jar and let it cool at room temperature.


Figure 3: moisturizer and anti-wrinkle treatment product.

Figure 4: "burn relief ointment for soothing and healing minor burns.

For black seed oil it can be used to treatment the joints. By mixing half a spoon of black seed oil with half a spoon of honey then adding cup of apple cider vinegar to the mixture by stirring the product is formed as in Figure 5 which can be used twice daily to relieve arthritis.

Figure 5: product of joints treatment.

## 4. Results of Research

From the previous experiments that carried out for extraction of different oils, sesame, flaxseed and black cumin oils are extracted using ethanol as a solvent of extraction for sesame oil and petroleum ether for flaxseed and black cumin oils. The structures of extracted oils have been proved by confirmatory chemical tests as saponification ,iodine test and using acidified KMnO4. Different applications are achieved using these oils, sesame oil is used in production of body lotion and sunscreen with other additives. Flaxseed oil is used to produce a product for moisturizer and anti-wrinkle treatment and burn relief ointment for soothing and healing minor burns. As well as black cumin oil is used to produce a product of the treatment of joints.

## 5. Interpretation of Results

Extraction of sesame, flaxseed and black seed (black cumin) oils is achieved using solvent extraction technique, due to the availability and higher yield of extracted oil. For sesame oil, the confirmatory experiments ensure the presence of sesame oil as in the saponification test the formed foam

indicated the presence of unsaturated fatty acids which verify the structure of sesame oil that compose from monounsaturated fatty acid (oleic acid) and polyunsaturated fatty acid (linoleic acid) (Anilakumar et al., 2010, 160). We utilize the properties of sesame oil as antibacterial and antifungal to treat certain skin care products with other additives. Flaxseed oil extracted using solvent extraction method using petroleum ether, the confirmatory tests carried out to ensure that the extracted oil is flaxseed oil as saponification test detects the presence of flaxseed oil by breaking down fats or oils through a reaction with a strong base, such as sodium hydroxide (NaOH), to produce soap and glycerol. Since flaxseed oil is rich in unsaturated fatty acids omega 3. the iodine colour disappears quickly, this indicates a high content of unsaturated double bonds, confirming the presence of flaxseed oil. Finally, black cumin oil is extracted using petroleum ether, its composition is estimated by saponification test which indicate the presence of unsaturated fatty acids. Due to the presence of thymoquinone, which has anti-nociceptive, hypotensive, bronchodilator, anti-histaminic, anti-fertility, spasmolytic, immune stimulating, choleretic, uricosuric, hypoglycemic, hepatoprotective, neuroprotective, milk production, anti-tussive, anti-inflammatory, anti-carcinogenic, anti-hyperlipidemic, anti-cancer, antioxidant, antidiabetic, anti-hypertensive, analgesic, and anticonvulsant properties, black cumin oil with other additives are mixed to produce a product to the treatment of the joints.

## 6. Conclusion

In conclusion, the process of extracting oils from sesame, flax seeds and black seed has proven its importance in producing oils rich in nutritional values and beneficial compounds are useful in food, pharmaceutical and cosmetic fields.


## Acknowledgement

With great pride and deep gratitude, we extend our sincere thanks and appreciation to the Faculty of Education – Ain shams university– Department of Chemistry, this esteemed academic institution where we had the honour of learning and belonging. It has always supported us with knowledge, expertise, and an environment that fosters research and creativity. We would also like to express our heartfelt thanks to Dr. EL-Shimaa Ibrahim, our project supervisor, for her continuous academic support, insightful guidance, and kind patience in following every detail. She has truly been a role model of academic excellence and personal dedication. Our gratitude also goes to all the faculty members, technical staff, and administrative personnel who have assisted us throughout this journey.


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